SURVEY OF THE FISH ASSEMBLAGES IN THE NONWADEABLE WATERS OF THE SYDENHAM RIVER IN 2003

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ABSTRACT

Marson, D. and N.E. Mandrak. 2009. Survey of the fish assemblages in the nonwadeable waters of the Sydenham River in 2003. Can. Manuscr. Rep. Fish. Aquat. Sci. 2916: v + 21 p.

In 2003, Fisheries and Oceans Canada conducted a survey of the fish assemblages in the nonwadeable waters of the Sydenham River. Both active and passive gears were used during the sampling. Active sampling included boat electrofishing and boat seining; passive sampling included gill nets, fyke nets and minnow traps (which were used in conjunction with fyke net sampling). Sites were sampled by multiple gear types to catch the greatest diversity of fishes possible and to determine the most suitable gear for sampling fish communities, including species at risk, in nonwadeable, turbid rivers. A total of 27 sites were sampled, and resulted in the capture of 458 fishes representing 34 species (including two fish SAR). Active sampling accounted for 390 fishes representing 30 species (including both SAR), and passive sampling accounted for 68 fishes representing 18 species. The objectives of the study were to perform a survey of the fish assemblages in nonwadeable habitats, to compare gear effectiveness in capturing a diversity of fishes, and to document the current distribution of fish SAR in the nonwadeable waters of the Sydenham River.

RÉSUMÉ

Marson, D. and N.E. Mandrak. 2009. Survey of the fish assemblages in the nonwadeable waters of the Sydenham River in 2003. Can. Manuscr. Rep. Fish. Aquat. Sci. 2916: v + 21 p.

En 2003, Pêches et Océans Canada (MPO) a effectué un relevé des assemblages de poissons dans les eaux non praticables à pied de la rivière Sydenham. Des engins actifs et passifs ont servi lors de l'échantillonnage. L'échantillonnage actif comprenait la pêche à l'électricité et à la senne en bateau; l'échantillonnage passif a été effectué au moyen de filets maillants, de verveux et de nasses à vairon (utilisés en concomitance avec l'échantillonnage au verveux). L'échantillonnage des lieux a été effectué au moyen de nombreux types d'engins afin de capturer des poissons de la plus grande diversité possible et de déterminer le type d'engin le plus convenable à l'échantillonnage de communautés de poissons, y compris celles d'espèces en péril (EP) dans des rivières turbides non praticables à pied. Au total, 27 lieux ont été échantillonnés, ce qui a eu pour résultat que 458 poissons, représentant 34 espèces (dont deux EP) ont été capturés : 390 poissons, représentant 30 espèces (dont les deux EP) par l'échantillonnage actif et 68 poissons, représentant 18 espèces, par l'échantillonnage passif. L'étude avait pour objectif d'effectuer un relevé des assemblages de poissons dans des habitats non praticables à pied, de comparer l'efficacité des engins pour capturer une diversité de poissons et de consigner les renseignements sur la répartition actuelle d'espèces de poisson en péril dans les eaux non praticables à pied de la rivière Sydenham.

INTRODUCTION

The Sydenham River watershed originates near the city of London, Ontario and flows southwest into Lake St. Clair. The Sydenham River watershed contains a high diversity of fishes, close to 80 species, including records for seven fishes currently listed as species at risk (SAR) (Staton et al. 2003). In the summer of 2003, Fisheries and Oceans Canada conducted a survey of the fish assemblages of the Sydenham River. Nonwadeable habitats were specifically targeted using both active and passive sampling methods. Active methods included boat electrofishing and boat seining, while passive methods included gill nets, fyke nets and minnow traps (which were used in conjunction with fyke net sampling). Sites were selected based on accessibility and suitability for sampling. A total of 27 sites were sampled, resulting in the capture of 458 fishes representing 34 species. Two species at risk, the Blackstripe Topminnow (*Fundulus notatus*) and Silver Shiner (*Notropis photogenis*), both listed as Special Concern, were collected from three sites.

The objectives of the study were to perform a survey of the fish communities in nonwadeable habitats, to compare gear effectiveness in capturing a diversity of fishes, and to document the current distribution of fish SAR in the Sydenham River.

METHODS

SITE SELECTION

Nonwadeable sampling sites in the Sydenham River were selected based on their proximity to boat launches. Sites were generally sampled both upstream and downstream from boat launch sites. Sampling of the fish communities of the Sydenham River was conducted using both active and passive sampling methods. Sampling techniques included using one or more of the following methods: boat electrofishing, boat seining, gill netting, fyke netting and minnow traps. All sites were sampled using multiple gear types and an emphasis was placed on re-sampling the site within 24 hours with a second gear type. Eleven areas between the towns of Wallaceburg and Dresden were selected and divided into 27 sites, each site representing a different gear type. For example, the first area sampled contained both Site 1 and Site 4 (sampled by fyke net and boat electrofishing, respectively). All of the areas selected were sampled by boat electrofishing and by up to two other gear types. Upon the completion of sampling, fishes were identified, measured (minimum and maximum total lengths), and vouchers were kept for verification in a laboratory. Following laboratory verification, vouchers were sent to the Royal Ontario Museum for further verification and cataloguing or disposal.

SAMPLING METHODS

Active Gears

Boat Electrofishing: Electrofishing was performed using a 4.27 m electrofishing boat equipped with a 5.0 kW Smith-Root model generator, 5.0 GPP control box and dual foot pedals. A single netter retrieved stunned fishes, transferring them into water-filled buckets in the boat. Sampling time was recorded as seconds shocked for each site (11 sites in total).

Boat Seining: Seining was performed using a 60.96 m seine net with 6.35 mm ace mesh. Seine hauls were performed in the direction of flow. Fishes were transferred from the seine net into buckets filled with water. Obstructions in the sites limited the effort to a single haul at each of the three sites sampled.

Passive Gears

Fyke Net, Large Mesh: A 1.2 m large mesh (25 mm) fyke net was used alone (six sites) or in conjunction with minnow traps (two sites). Two minnow traps were set at either side of the lead, but within the area of the wings. The nets/traps were set and left overnight and, upon fishing, the effort was recorded as hours of set time.

Fyke Net, Small Mesh: A 1.2 m small mesh (6.35 mm) fyke net was used to sample three sites. The nets were set and left overnight and upon fishing, the effort was recorded as hours of set time.

Gill Net: A 30.5 m gill net with 25 mm mesh was used to sample two sites. Effort was recorded as the number of hours set.

HABITAT DATA COLLECTION

Habitat data collected included stream width (m), distance from shore (m), maximum sampling depth (m), water flow, water temperature (°C), and conductivity (µS). Habitat data were collected following the completion of sampling.

RESULTS

SAMPLING

Boat Electrofishing

A total of 11 sites were sampled by boat electrofishing on August 3 (Sites 4, 5, 6), August 8 (Sites 10, 11, 12), and September 4 (Sites 23-27). All of the 11 areas were sampled by boat electrofishing (Figure 1, Appendix 3). A total of 179 fishes representing 22 species were detected including six species unique to boat electrofishing (Tables 1 and 3). The Gizzard Shad (common and scientific names

according to Nelson et al. 2004; see Appendix 1) was by far the most common species captured (n = 103). The total fishing effort was 2977 sec, ranging from 208 to 291 sec, with a mean of 271 sec (Table 2). The CPUE was 0.06 fish/sec (216 fish/h), with a mean of 27 species/hr.

Boat Seine

Three sites were sampled by boat seine on August 12 (Sites 16, 17, 18). A total of 211 fishes representing 16 species and three unknown species (possibly represented in the 16 known spp.) were detected, including five species unique to boat seining (Tables 1 and 3). The most common species captured was the Gizzard Shad (n = 161). The total fishing effort was three hauls, one haul at each of the three sites sampled (Table 2). The CPUE was 70 fish/haul, with a mean of 5.7 species/haul.

When compared individually to the other sampling methods at the specific sites, it is clear that boat seining captured both more fishes and more diversity than alternative sampling methods. In area 7, Sites 13, 16 and 23 were sampled by large-mesh fyke net/minnow trap combination (LFN + MT), boat seine (BSN) and boat electrofishing (BEF), respectively (Appendices 3 and 12). Boat seining captured 64 fishes representing 10 species, while boat electrofishing captured 14 fishes representing five species, and the LFN + MT combination captured 20 fishes representing seven species (Appendix 12). Of the species identified, only two were common between more than one of the sampling gears (Common Carp was caught by BEF and LFN + MT, and Gizzard Shad was caught by BEF and BSN). In area 8, Sites 14, 18 and 26 were sampled by small-mesh fyke net (SFN), BSN, and BEF, respectively (Figure 1, Appendix 11). SFN caught three fishes representing three species, BSN captured 32 fishes representing eight species, and BEF captured 34 fishes representing seven species. Of the species captured, three were caught by multiple gears (freshwater drum by both SFN and BEF; Gizzard Shad by BEF and BSN; and Rock Bass by BSN and SFN). In area 9, Sites 15, 17 and 27 were sampled by large-mesh fyke net (LFN), BSN, and BEF, respectively (Figure 1, Appendix 11). LFN captured two fishes representing two species, BSN captured 115 fishes representing 11 species, and BEF captured 37 fishes representing eight species (Appendix 12). LFN and BSN had one species in common (Common Carp), while BEF and BSN had three species in common (Emerald Shiner, Gizzard Shad and Spotfin Shiner).

In each of the three areas sampled, boat seining had the greatest number of species captured and had the highest total number of fishes captured in two of the three areas.

Fyke Net, Large Mesh

A total of six sites were sampled using large-mesh fyke nets (25 mm mesh) on August 6, 7, 8, 12 (Sites 1, 8, 9 and 15, respectively) and two on September 3 (Sites 21 and 22). A total of 15 fishes representing nine species, were detected (Table 1). The most common species captured were Common Carp (n = 4), Bluegill (n = 3), and White

Perch (n = 2). The total fishing effort was 118.5 h, ranging from 13 to 26 h, with a mean of 19.75 h (Table 2). The CPUE was 0.13 fish/h with a mean of 0.08 species/h.

When compared individually to the other gears sampled at the sites, large-mesh fyke net had a low total catch, and low diversity of fishes captured. In area 1, LFN caught three fishes representing three species, and BEF caught 11 fishes representing six species (Appendices 3 and 12). One species, Bluegill, was caught by both gears. In area 5, LFN caught two fishes representing two species, and BEF caught 13 fishes representing three species. In area 6, LFN caught three fishes representing two species, and BEF caught 16 fishes representing four species. One species, Northern Pike, was caught by both gears in area 6. Sampling in area 9 is described in BSN sampling results. In area 10, LFN caught two fishes representing one species, gill net (GN) caught three fishes representing three species, and BEF caught 24 fishes representing 11 species (Appendix 12). The only species caught by LFN in area 10 (Common Carp) was also captured by gill net and Golden Redhorse was caught by both GN and BEF. In area 11, LFN caught three fishes representing three species, GN caught 16 fishes representing three species, and BEF caught 17 fishes representing six species. One species, Channel Catfish, was caught by both GN and LFN.

Fyke Net, Small Mesh

A total of three sites were sampled using small-mesh fyke nets (6.35 mm mesh) on August 6, 7 and 12 (Sites 2, 7 and 14, respectively). A total of nine fishes representing six species, were detected (Table 1). The most common species were Black Crappie (n = 3) and Gizzard Shad (n = 2). The total fishing effort was 73 h, ranging from 23 to 26 h each set, with a mean effort of 24 h (Table 2). The CPUE was 0.12 fish/h, with a mean of 0.08 species/h.

When compared individually, small-mesh fyke net (SFN) had a low total catch and species diversity compared to other sampling gears. SFN success was greatest in area 2, where SFN caught four fishes representing two species and BEF caught 5 fishes representing three species (Appendices 3 and 12). However, in area 4, SFN caught two fish representing one species, and BEF caught five fishes representing four species, including gizzard shad, which was the only species caught by SFN. SFN was also used to sample area 8 which is described in the boat seine sampling.

Fyke Net, Large Mesh + Minnow Traps

Two sites were sampled using large-mesh fyke nets in combination with minnow traps. Site 3 was sampled on August 6, and Site 12 was sampled on August 12 (Appendix 3). A total of 25 fishes representing 11 species, were detected (Tables 1 and 3). The most common species captured was Common Carp (n = 9). The total fishing effort was 49 h, ranging from 23 to 26 h each set, with a mean effort of 25 h (Table 2). The CPUE was 0.51 fish/h, with a mean of 0.22 species/h.

When compared individually, the large-mesh fyke net/minnow trap combination (LFN + MT) was more successful than boat electrofishing at capturing a greater number and diversity of fishes. In area 3, LFN + MT caught five fishes representing four species, where BEF caught three fishes representing three species. Sampling in area 7 is described in BSN sampling results. In both instances where LFN + MT were sampled in combination with BEF, the LFN + MT combination accounted for more fishes and more species (Appendices 3 and 12).

Gill Net

Two gillnet sites were sampled on August 13 (Sites 19 and 20). A total of 19 fishes representing six species were detected (Tables 1 and 3). The most common species captured were White Bass (n = 8) and Walleye (n = 6). The total fishing effort was two hours, both sites were one-hour sets (Table 2). The CPUE was 9.5 fish/h with a mean of 3 species/h.

Examined individually, gill net sampling captured fewer total fishes and fewer species than active sampling at the same locations. Gill net sampling occurred in areas 10 and 11, described in large-mesh fyke net sampling results.

SPECIES AT RISK

Two species at risk were captured during the 2003 nonwadeable sampling of the Sydenham River. The Blackstripe Topminnow, Special Concern, was collected from Sites 16 and 26. Site 16 was sampled by boat seine while Site 26 was sampled by boat electrofishing (Appendices 3 and 12). Four Blackstripe Topminnows were captured in total – two at Site 16 and two at Site 26.

The Silver Shiner, Special Concern, was collected at Site 17, which was sampled by boat seine (Appendices 3 and 12). A single specimen was captured.

HABITAT DATA

Habitat characteristics at the 2003 Sydenham River nonwadeable sampling sites are found in Appendix 10. Sampling depth ranged from 1 m to approximately 5 m depth. Water flow was recorded as either slow (15 sites) or no discernable flow (12 sites) for all of the sites sampled. Stream width was 25 or 30 m for all of the sites sampled. Water temperature was measured on August 7, 8 and September 4, and it ranged from a high of 26°C in August, to a low of 24.3°C in September. Sampling distance from shore varied from 3 m to 15 m with a sampling distance from shore of 5 m most often used (19 sites).

DISCUSSION

FISH ASSEMBLAGES

A total of 27 nonwadeable sites were sampled by active (14 sites) and passive (13 sites) gear types. Active sampling was performed by boat electrofishing (11 sites) and boat seining (3 sites). Passive sampling gear included large-mesh fyke net (6 sites), small-mesh fyke net (3 sites), large-mesh fyke net and minnow traps combined (2 sites), and gill nets (2 sites). Examined individually, boat electrofishing resulted in the highest fish diversity (n = 22) of active gears, while boat seining was lowest (n = 17). Of the passive gear types, large-mesh fyke net and minnow trap combination had the greatest fish diversity (n = 22), while small-mesh fyke net and gill net sampling had the lowest (n = 6) (Table 1). Gill net sampling had the highest CPUE of passive gears (9.5 fish/h, Table 2).

Active sampling accounted for more species, including all of the species at risk captured, higher total number of fishes caught, and a higher CPUE compared to passive sampling. Boat electrofishing occurred at all of the areas sampled during the 2003 Sydenham River nonwadeable sampling. Because of the high number of sites sampled by boat electrofishing, it was responsible for the highest number of species detected (n = 22) and the greatest number of unique species (n = 6). Boat seining was conducted at three sites and resulted in the highest total number of fishes caught (n = 211). Boat seining caught more fishes in total and more species than boat electrofishing, when comparing the three sites where both sampling gears were used. Boat seining had a mean catch of 10 species per site while boat electrofishing caught a mean of five species per site (Table 1). Therefore, had the boat seine been used at more sites it may have resulted in an equal, or greater, number of species being detected than by boat electrofishing.

The large-mesh fyke net minnow trap combination accounted for the greatest success among passive gears related to total fishes (n = 25), total species (n = 11), mean fishes per site (n = 13), mean species per site (n = 6), and maximum fishes per site (n = 20) (Table 1). Gill net sampling was most successful among passive gears in terms of mean fishes caught per hour (n = 9.5) and mean species caught per hour (n = 3) (Table 2). Large-mesh fyke net sampling was the only passive method to capture unique species (Pumpkinseed and White Perch). Four species in total were captured by passive samplings and not captured by active samplings. However, of these unique species, only two Brown Bullhead, five Channel Catfish, one Pumpkinseed, and two White Perch were caught in total. Therefore, the species may have existed in very low numbers in the area of the sites and only in area 11 (where Sites 20, 22, 25 were sampled) was a species (Channel Catfish) caught by both passive gears and not by the active gear (Appendix 12). This may have been due to the water turbidity affecting the netter's ability to locate the fishes, or may have been due to obstructions that reduced the netter's ability to reach stunned fishes. Alternatively, 15 species were captured by active samplings that were not captured during passive samplings. Of these, seven species were represented by only a single specimen and 13 species had five or fewer individuals caught in total. This would suggest that active sampling is more effective at

catching both total numbers and diversity of fishes than passive sampling. However, comparing the two sites where boat electrofishing and large-mesh fyke net combined with minnow traps were set, the passive gear resulted in more fishes (n = 25 vs 17) and greater diversity (n = 11 vs 5). Only a single species, Common Carp, was caught in the two areas by both active and passive gears.

Gear effectiveness, based on the number of species collected per site, ranked as follows: boat seine (10), large-mesh fyke net minnow trap combination (6), boat electrofishing (5), gill net (3) and, both large-mesh fyke net and small mesh fyke net tied with the lowest results (2) (Table 1). Clearly, active sampling was more effective at catching a diversity of fishes; however, the combination of active and passive sampling resulted in the capture of additional species in all but one combination (SFN and BEF in area 4). Therefore, when attempting to catch the greatest diversity of fishes possible, as is the goal of fish assemblage surveys, a combination of active and passive methods is the most effective means of achieving this goal.

SPECIES AT RISK IN THE SYDENHAM RIVER

SAR and Associated Habitat Characteristics

Two fish SAR were captured in the Sydenham River during the 2003 nonwadeable sampling.

Blackstripe Topminnow: Four Blackstripe Topminnows were detected at Sites 16 and 26. Site 16 was sampled by boat seine and resulted in the capture of two specimens. Large-mesh fyke net/minnow traps (Site 13) and boat electrofishing (Site 23) were also sampled at the same location as Site 16 but were unsuccessful in detecting any Blackstripe Topminnow. The remaining two specimens were captured from Site 26 which was sampled by boat electrofishing. Small-mesh fyke net (Site 14) and boat seine (Site 18) were also sampled on the same location as Site 26 but did not detect any Blackstripe Topminnow. Site 16 was sampled 15 m from shore, in an area of slow current, with a depth greater than 1 m. Site 26 was sampled 5 m from shore, in an area of slow current, with a depth of 2 m. Water temperature at Site 26 was 24.3°C and conductivity was 521 µS. Although physical habitat data are unavailable for these sites, it has been documented that Blackstripe Topminnow prefers areas with dense vegetation cover and slow currents and can withstand water with high turbidity (Mandrak and Holm 2000).

Silver Shiner: One Silver Shiner was captured by boat seine at Site 17. Large-mesh fyke net (Site 15) and boat electrofishing (Site 27) were also used to sample the same location as Site 17 but were unsuccessful in detecting Silver Shiner. The stream width at the site was 25 m, maximum sampling depth was 2 m, and the flow at the site was slow. Substrate and aquatic vegetation data were not recorded. Silver Shiners are often captured in clear, swift flowing water, but it has been suggested by Baldwin (1988) that current speed is not important. Silver Shiners seem to prefer greater water depths,

and accordingly they tend to locate in the pool sections of rivers. Open water habitats appear to be preferred to areas with submerged aquatic vegetation (Baldwin 1988).

RECOMMENDATIONS FOR STANDARDIZED SAMPLING OF NON-WADEABLE HABITATS

The results from this study suggest that sampling efforts should emphasize the use of both active and passive gears, especially (in order of effectiveness) boat electrofishing, boat seining, and fyke net-minnow trap combinations. Short-set gillnetting and fyke-nets alone are not recommended. The use of multiple gears at a single site is recommended.

Additional sampling in the nonwadeable portions of the Sydenham River should be conducted using two or more of the gears recommended above in order to assess the current distribution and abundances of fish SAR. Although two SAR were captured during the current study, only five specimens in total were captured. Future sampling should target fish SAR historically known from the Sydenham River (including Bigmouth Buffalo, Northern Madtom, Pugnose Minnow, Spotted Gar, and Spotted Sucker) to update current population sizes and distributions, and the habitat preferences of the species.

ACKNOWLEDGEMENTS

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Table 1: Summary of catch data for nonwadeable sites sampled on the Sydenham River, 2003. BEF – boat electrofishing; BSN – boat seine; LFN – large-mesh fyke net; SFN – small-mesh fyke net; LFN+MT – large-mesh fyke net/minnow trap combination; GN – gill net.

	Gear Type						
Catch Data	**BEF**	**BSN**	**LFN**	**SFN**	**LFN + MT**	**GN**	**Total**
Number of Sites Sampled	11	3	6	3	2	2	27
Total Species Detected	22	17*	9	6	11	6	34*
Total Fishes Caught	179	211	15	9	25	19	458
Mean Fishes Caught/Site	16	70	2.5	3	13	10	17
Mean Species Caught/Site	5	10	2	2	6	3	5
Maximum Number of Fishes Caught/Site	37	115	3	4	20	16	115
Minimum Number of Fishes Caught/Site	3	32	2	2	5	3	2
Species at Risk Detected	1	2	0	0	0	0	2

*excluding unknown Catostomidae, unknown Centrarchidae, and unknown *Pomoxis* spp.

Table 2: Summary of the sampling effort for Sydenham River, 2003 nonwadeable site sampling. BEF – boat electrofishing; BSN – boat seine; LFN – large-mesh fyke net; SFN – small-mesh fyke net; LFN+MT – large-mesh fyke net/minnow trap combination; GN – gill net.

Sampling Effort	**BEF (seconds)**	**BSN (hauls)**	**LFN (hours)**	**SFN (hours)**	**LFN + MT (hours)**	**GN (hours)**
Total Effort	2977	3	118.5	73	49	2
Mean Effort	271	1	19.75	24	25	1
Maximum Effort	291	1	26	26	26	1
Minimum Effort	208	1	13	23	23	1
CPUE (fish/hour)	216	70 (*fish/haul)	0.13	0.12	0.51	9.5
CPUE (species/hour)	27	5.7** (*spp/haul)	0.08	0.08	0.22	3

** excluding unknown Catostomidae, unknown Centrarchidae, and unknown *Pomoxis* sp.

Table 3: Species detected at nonwadeable sites sampled in the Sydenham River, 2003. BEF – boat electrofishing; BSN – boat seine; LFN – large-mesh fyke net; SFN – small-mesh fyke net; LFN+MT – large-mesh fyke net/minnow trap combination; GN – gill net.

Species	Active Gear Types		Passive Gear Types			
	BEF	BSN	LFN	SFN	LFN + MT	GN
Black Crappie						
Blackstripe Topminnow **(SC)**						
Bluegill						
Bluntnose Minnow						
Brook Silverside						
Brown Bullhead						
buffalo sp.						
centrarchid sp.						
Channel Catfish						
Common Carp						
Common Shiner						
crappie sp.						
Emerald Shiner						
Freshwater Drum						
Ghost Shiner						
Gizzard Shad						
Golden Redhorse						
Green Sunfish						
Largemouth Bass						
Log Perch						
Longnose Gar						
Mimic Shiner						
Northern Pike						
Pumpkinseed						
Quillback						
Rock Bass						
Shorthead Redhorse						
Silver Redhorse						
Silver Shiner **(SC)**						
Spotfin Shiner						
sucker sp.						
Walleye						
White Bass						
White Crappie						
White Perch						
White Sucker						
Yellow Perch						
Total Species	**22**	**19***	**9**	**6**	**11**	**6**
Unique Species	**6**	**5***	**2**	**0**	**0**	**0**
Total Species Richness	**37* (34 identified to species)**					

*excluding an unknown sucker, unknown centrarchid, and unknown crappie.

SC – Special Concern

Legend	Present	Absent

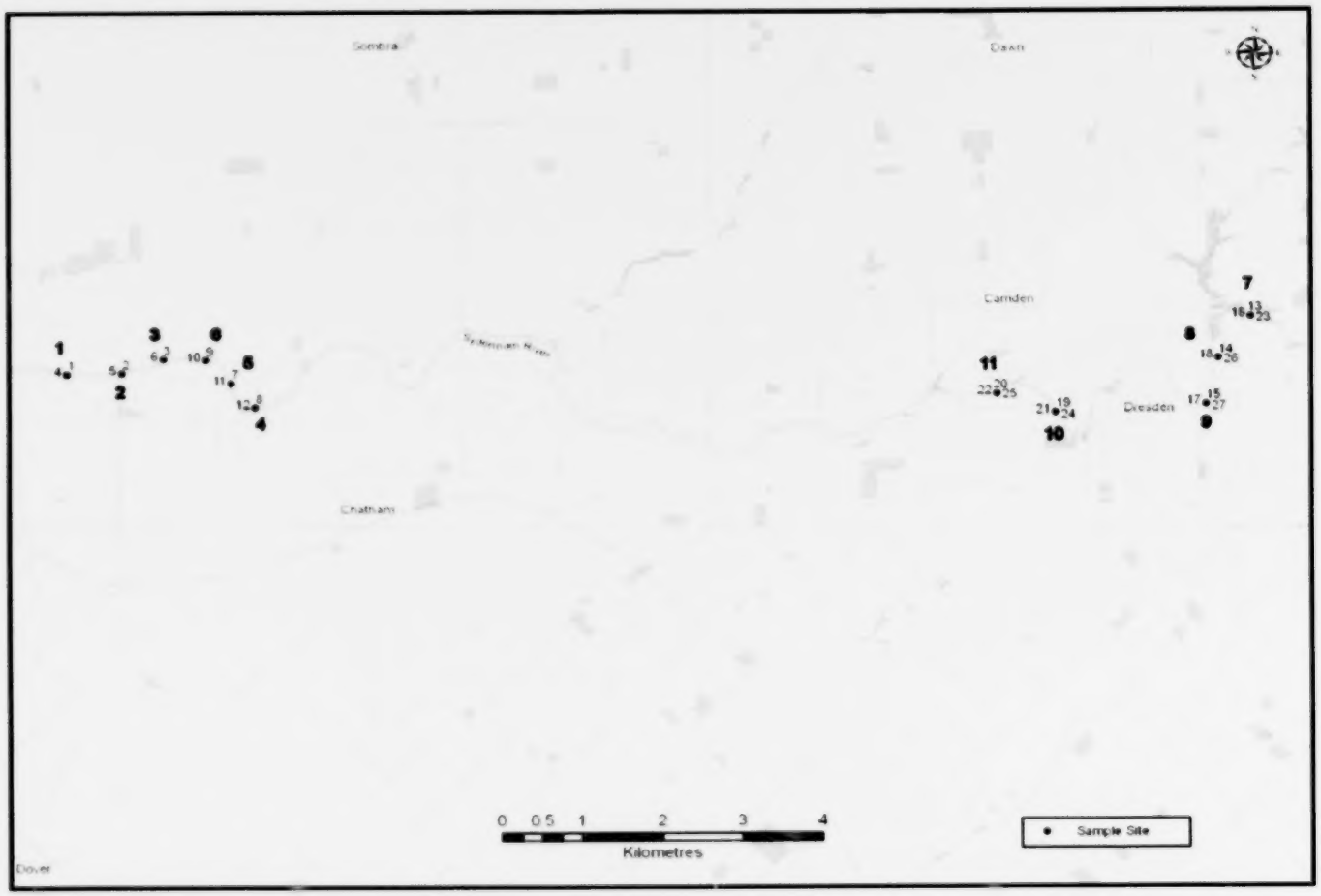

Figure 1: Sites sampled during the survey of fish assemblages in the nonwadeable waters of the Sydenham River in 2003. Site # corresponds to map # in Appendix 2. Bold numbers represent area #, which correspond to number in Appendix 12.

Appendix 1: Common and scientific names of species detected in the Sydenham River, 2003 nonwadeable sampling (according to Nelson et al. 2004).

Common Name	Scientific Name
Black Crappie	*Pomoxis nigromaculatus*
Blackstripe Topminnow	*Fundulus notatus*
Bluegill	*Lepomis macrochirus*
Bluntnose Minnow	*Pimephales notatus*
Brook Silverside	*Labidesthes sicculus*
Brown Bullhead	*Ameiurus nebulosus*
buffalo sp.	*Ictiobus* sp.
centrarchid sp.	*Centrarchidae*
Channel Catfish	*Ictalurus punctatus*
Common Carp	*Cyprinus carpio*
Common Shiner	*Luxilus cornutus*
crappie sp.	*Pomoxis* sp.
Emerald Shiner	*Notropis atherinoides*
Freshwater Drum	*Aplodinotus grunniens*
Ghost Shiner	*Notropis buchanani*
Gizzard Shad	*Dorosoma cepedianum*
Golden Redhorse	*Moxostoma erythrurum*
Green Sunfish	*Lepomis cyanellus*
Largemouth Bass	*Micropterus salmoides*
Log Perch	*Percina caprodes*
Longnose Gar	*Lepisosteus osseus*
Mimic Shiner	*Notropis volucellus*
Northern Pike	*Esox lucius*
Pumpkinseed	*Lepomis gibbosus*
Quillback	*Carpiodes cyprinus*
Rock Bass	*Ambloplites rupestris*
Shorthead Redhorse	*Moxostoma macrolepidotum*
Silver Redhorse	*Moxostoma anisurum*
Silver Shiner	*Notropis photogenis*
Spotfin Shiner	*Cyprinella spiloptera*
sucker sp.	*Catostomidae* sp.
Walleye	*Sander vitreus*
White Bass	*Morone chrysops*
White Crappie	*Pomoxis annularis*
White Perch	*Morone americana*
White Sucker	*Catostomus commersonii*
Yellow Perch	*Perca flavescens*

Appendix 2: Sydenham River 2003 nonwadeable sampling site descriptions. Map number corresponds to number on Figure 1.

Map #	Latitude	Longitude	Site Description
1	42.35843	-82.20640	3 km upstream from Murray St. Bridge, Wallaceberg - south bank.
2	42.35837	-82.20145	3.5 km upstream from Murray St. Bridge, Wallaceberg - south bank.
3	42.35933	-82.19762	4 km upstream from Murray St. Bridge, Wallaceberg - north bank.
4	42.35843	-82.20647	Boat electrofished 100 m upstream and downstream from SYD060803001
5	42.35837	82.20145	Boat electrofished 100 m up and downstream from SYD060803002
6	42.35933	-82.19762	Boat electrofished 100 m up and downstream from SYD060803003
7	42.35734	-82.19151	5 km upstream of Murray St. bridge, Wallaceberg - north bank
8	42.35546	-82.18944	5.5 km upstrem of Murray St. bridge, Wallaceberg - north bank
9	42.35914	82.19374	4.5 km upstream of Murray St. bridge, Wallaceberg - south bank.
10	42.35914	-82.19374	Boat electrofished 100 m up and downstream from SYD080803001
11	42.35734	-82.19151	Boat electrofished 100 m up and downstream of SYD070803004 - north bank
12	42.35546	-82.18944	Boat electrofished 100 m up and downstream from SYD070803005 - north bank
13	42.35973	-82.09856	3 km upstream from Dresden Main St. - south bank
14	42.35663	-82.10168	2 km upstream from Dresden Main St. bridge - north bank.
15	42.35322	-82.10296	1 km upstream from Dresden Main St. bridge - north bank.
16	42.35973	-82.09856	3 km upstream of Dresden Main St. bridge, south bank; at location of SYD120803001
17	42.35322	-82.10296	Boat seined at location of site SYD120803003 - south bank
18	42.35663	-82.10168	2 km upstream from Dresden Main St. bridge, south bank. At location of SYD120803002
19	42.35299	-82.11668	Gillnet set across full width of river at same location as site SYD030903001
20	42.35459	-82.12194	Gillnet set across full width of river at same location as site SYD030903003
21	42.35299	-82.11668	1 km downstream of Dresden boat launch (within Dresden CA) - at baseball diamond
22	42.35459	-82.12194	2 km downstream of Dresden boat launch (within Dresden CA)
23	42.35973	-82.09856	Boat electrofished 100 m up/downstream from SYD120803001
24	42.35299	-82.11668	100 m up and downstream of site code SYD030903001 - north bank
25	42.35459	-82.12194	100 m upstream/downstream from site code SYD030903003 - south bank
26	42.35663	-82.10168	100 m upstream of SYD120803002 - north bank
27	42.35322	-82.10296	100 m upstream/downstream of site code: SYD120803003 - north bank

Appendix 3: Summary of effort and gear types for nonwadeable sampling of the Sydenham River in 2003. Site number corresponds to number on Figure 1.

Map#	Method	Effort	Effort	Electrofishing Settings	Description of Method
1	Fyke net, large mesh	26	hours		Fyke net large, 25 mm mesh
2	Fyke net, small mesh	26	hours		Fyke net small, 6.35 mm mesh
3	Fyke net, minnow trap	26	hours		Fyke net large, 25 mm mesh; and a minnow trap
4	Boat electrofishing	287	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
5	Boat electrofishing	272	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
6	Boat electrofishing	283	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
7	Fyke net, small mesh	24	hours		Fyke net small, 6.35 mm mesh
8	Fyke net, large mesh	21	hours		Fyke net large, 25 mm mesh
9	Fyke net, large mesh	22.5	hours		Fyke net large, 25 mm mesh
10	Boat electrofishing	289	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
11	Boat electrofishing	229	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
12	Boat electrofishing	208	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
13	Fyke net, minnow trap	23	hours		Fyke net large, 25 mm mesh; and a minnow trap
14	Fyke net, small mesh	23	hours		Fyke net small, 6.35 mm mesh
15	Fyke net, large mesh	23	hours		Fyke net large, 25 mm mesh
16	Seine, boat	1	haul		Boat seine; 60.96 m; 6.35 mm mesh
17	Seine, boat	1	haul		Boat seine; 60.96 m; 6.35 mm mesh
18	Seine, boat	1	haul		Boat seine; 60.96 m; 6.35 mm mesh
19	Gill net	1	hours		Gill net; 30.5 m, 25 mm mesh
20	Gill net	1	hours		Gill net; 30.5 m, 25 mm mesh
21	Fyke net, large mesh	13	hours		Fyke net large, 25 mm mesh
22	Fyke net, large mesh	13	hours		Fyke net large, 25 mm mesh
23	Boat electrofishing	291	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
24	Boat electrofishing	281	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
25	Boat electrofishing	289	seconds	1000v 30hz@55% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
26	Boat electrofishing	272	seconds	1000v 30hz@50% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom
27	Boat electrofishing	276	seconds	1000v 30hz@50% =	4.27 m Efishing Boat (LOWE), 5.0 Kw, single boom

Appendix 4: Effort expended and species caught at boat electrofishing sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Common name	Total	Relative Abundance	4	5	6	10	11	12	23	24	25	26	27
Black Crappie	1	0.56								1			
Blackstripe	2	1.12										2	
Bluegill	1	0.56	1										
Bluntnose Minnow	1	0.56								1			
Brook Silverside	18	10.06							3	2	1	8	4
buffalo sp.	4	2.23	2			2							
Common Carp	6	3.35		1	1	1	1		1				1
Common Shiner	1	0.56							1				
Emerald Shiner	5	2.79									1	1	3
Freshwater Drum	3	1.68					1			1		1	
Gizzard Shad	103	57.54	1		1	12	2	11	8	12	12	20	24
Golden Redhorse	3	1.68								1	1		1
Green Sunfish	1	0.56										1	
Largemouth Bass	1	0.56								1			
Northern Pike	5	2.79			1	1			1	1		1	
Quillback	1	0.56						1					
Shorthead Redhorse	1	0.56									1		
Silver Redhorse	7	3.91	1	3						1			2
Spotfin Shiner	2	1.12									1		1
Walleye	6	3.35	1	1			1	1		2			
White Bass	6	3.35	5										1
Yellow Perch	1	0.56								1			
Total	179	100	11	5	3	16	5	13	14	24	17	34	37
Effort (seconds)			287	272	283	289	229	208	291	281	289	272	276
CPUE (fish/second)			0.04	0.02	0.01	0.06	0.02	0.06	0.05	0.09	0.06	0.13	0.13
Total Species			6	3	3	4	4	3	5	11	6	7	8
CPUE (species/hour)			75	40	38	50	63	52	62	141	75	93	104
Mean CPUE (fish/second)			0.06										
Mean CPUE (species/hour)			72										

Appendix 5: Effort expended and species caught at boat seining sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Species	**Total**	**Relative Abundance**	**16**	**17**	**18**
Black Crappie	**3**	**1.42**	2		1
Blackstripe	**2**	**0.95**	2		
Bluntnose Minnow	**2**	**0.95**			2
centrarchid sp.	**10**	**4.74**			10
crappie sp.	**5**	**2.37**		5	
Emerald Shiner	**2**	**0.95**	1	1	
Ghost Shiner	**4**	**1.9**	2	1	1
Gizzard Shad	**161**	**76.3**	50	100	11
Largemouth Bass	**1**	**0.47**		1	
Log Perch	**3**	**1.42**	1	2	
Longnose Gar	**1**	**0.47**	1		
Mimic Shiner	**5**	**2.37**	2	1	2
Rock Bass	**3**	**1.42**			3
Silver Shiner	**1**	**0.47**		1	
Spotfin Shiner	**2**	**0.95**	1	1	
sucker sp.	**1**	**0.47**		1	
White Crappie	**3**	**1.42**	2		1
White Sucker	**1**	**0.47**			1
Yellow Perch	**1**	**0.47**		1	
Total	**211**	**100**	**64**	**115**	**32**
Effort (hauls)			**1**	**1**	**1**
CPUE (fish/haul)			**64**	**115**	**32**
Total Species			**10**	**11**	**8***
CPUE (species/haul)			**10**	**11**	**8***
Mean CPUE (fish/haul)			**70.33**		
Mean CPUE (species/haul)			**10**		

* excluding unknown *centrarchid* sp. since it may not represent an additional species.

Appendix 6: Effort expended and species caught at large-mesh fyke net sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Species	Total	Relative Abundance	1	8	9	15	21	22
Black Crappie	1	6.67	1					
Bluegill	3	20	1		2			
Channel Catfish	1	6.67						1
Common Carp	4	26.67		1		1	2	
Northern Pike	1	6.67			1			
Pumpkinseed	1	6.67						1
Rock Bass	1	6.67	1					
White Crappie	1	6.67		1				
White Perch	2	13.33				1		1
Total	15	100	3	2	3	2	2	3
Effort (# hours)			26	21	22.5	23	13	13
CPUE (fish/hour)			0.12	0.1	0.13	0.09	0.15	0.23
Total Species			3	2	2	2	1	3
CPUE (species/hour)			0.12	0.1	0.09	0.09	0.08	0.23
Mean CPUE (fish/hour)			0.14					
Mean CPUE (species/hour)			0.12					

Appendix 7: Effort expended and species caught at small-mesh fyke net sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Species	Total	Relative Abundance	2	7	14
Black Crappie	3	33.33	3		
Brown Bullhead	1	11.11			1
Freshwater Drum	1	11.11			1
Gizzard Shad	2	22.22		2	
Rock Bass	1	11.11			1
White Bass	1	11.11	1		
Total	9	100	4	2	3
Effort (# hours)			26	24	23
CPUE (fish/hour)			0.15	0.08	0.13
Total Species			2	1	3
CPUE (species/hour)			0.08	0.04	0.13
Mean CPUE (fish/hour)			0.27		
Mean CPUE (species/hour)			0.08		

Appendix 8: Effort expended and species caught at large-mesh fyke net/minnow trap combination sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Species	Total	Relative Abundance	3	13
Black Crappie	2	8	2	
Bluegill	1	4	1	
Brown Bullhead	1	4		1
Channel Catfish	2	8		2
Common Carp	9	36		9
Freshwater Drum	2	8		2
Ghost Shiner	3	12		3
Golden Redhorse	1	4		1
Silver Redhorse	2	8		2
White Bass	1	4	1	
Yellow Perch	1	4	1	
Total	25	100	5	20
Effort (# hours)			26	23
CPUE (fish/hour)			0.19	0.87
Total Species			4	7
CPUE (species/hour)			0.15	0.30
Mean CPUE (fish/hour)			0.53	
Mean CPUE (species/hour)			0.23	

Appendix 9: Effort expended and species caught at gill net sites in the Sydenham River, 2003. Site number corresponds to number on Figure 1.

Species	Total	Relative Abundance	19	20
Rock Bass	1	5.26	1	
Common Carp	1	5.26	1	
Channel Catfish	2	10.53		2
White Bass	8	42.11		8
Golden Redhorse	1	5.26	1	
Walleye	6	31.58		6
Total	19	100	3	16
Effort (hours)			1	1
CPUE (fish/hour)			3	16
Total Species			3	3
CPUE (species/hour)			3	3
Mean CPUE (fish/hour)			9.5	
Mean CPUE (species/hour)			3	

Appendix 10: Habitat data for Sydenham River nonwadeable sites, 2003.

Map #	Water Temp (°C)	COND (µS)	Stream Width (m)	Distance from shore (m)	Max Sampling Depth (m)	Flow Rate	Aquatic Vegetation
1	na	na	30	5	2.0	None	na
2	na	na	30	5	2.0	None	na
3	na	na	30	5	2.0	None	na
4	25.7	343	30	5	<5	Slow	na
5	25.7	343	30	5	<5	None	na
6	25.7	343	30	5	<5	None	na
7	na	na	30	5	2.0	None	na
8	na	na	30	5	2.0	None	na
9	26	512	30	5	2.0	None	na
10	25.7	343	30	5	na	None	na
11	25.7	343	30	5	na	None	na
12	25.7	343	30	5	na	None	na
13	na	na	25	5	2.0	Slow	na
14	na	na	25	5	2.0	None	na
15	na	na	25	5	2.0	Slow	na
16	na	na	25	15	>1	Slow	na
17	na	na	25	5	2.0	Slow	na
18	na	na	25	15	1.0	Slow	na
19	na	na	30	na	na	Slow	na
20	na	na	30	na	na	Slow	na
21	na	na	30	na	na	Slow	na
22	na	na	na	na	na	Slow	na
23	24.3	521	25	5	2.0	Slow	na
24	24.3	521	30	na	na	Slow	na
25	24.3	521	30	3	na	Slow	na
26	24.3	521	25	5	2.0	Slow	na
27	24.3	521	25	5	2.0	Slow	na

Appendix 11: Species captured at sites located in the same location, by different gear types. Map # and Area # correspond to number on Figure 1. Common species are bolded.

Area #	**1**		**2**		**3**		**4**		**5**		**6**	
Species **Site**	**1**	**4**	**2**	**5**	**3**	**6**	**7**	**11**	**8**	**12**	**9**	**10**
Black Crappie	1		3		2							
Blackstripe Topminnow												
Bluegill	**1**	**1**			1						2	
Bluntnose Minnow												
Brook Silverside												
Brown Bullhead												
buffalo sp.		2										2
centrarchid sp.												
Channel Catfish												
Common Carp				1		1		1	1			1
Common Shiner												
crappie sp.												
Emerald Shiner												
Freshwater Drum								1				
Ghost Shiner												
Gizzard Shad		1				1	**2**	**2**		11		12
Golden Redhorse												
Green Sunfish												
Largemouth Bass												
Log Perch												
Longnose Gar												
Mimic Shiner												
Northern Pike						1					**1**	**1**
Pumpkinseed												
Quillback										1		
Rock Bass	1											
Shorthead Redhorse												
Silver Redhorse		1		3								
Silver Shiner												
Spotfin Shiner												
sucker sp.												
Walleye		1		1				1		1		
White Bass		5	1		1							
White Crappie									1			
White Perch												
White Sucker												
Yellow Perch					1							
Total Fishes	**3**	**11**	**4**	**5**	**5**	**3**	**2**	**5**	**2**	**13**	**3**	**16**
Total Species	**3**	**6**	**2**	**3**	**4**	**3**	**1**	**4**	**2**	**3**	**2**	**4**
Common Species	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**

Appendix 11: Continued

Area #	7			8			9			10			11		
Species **Site**	**13**	**16**	**23**	**14**	**18**	**26**	**15**	**17**	**27**	**19**	**21**	**24**	**20**	**22**	**25**
Black Crappie		2			1							1			
Blackstripe Topminnow		2				2									
Bluegill															
Bluntnose Minnow					2							1			
Brook Silverside			3			8			4			2			1
Brown Bullhead	1			1											
Buffalo Sp.															
centrarchid sp.*					10										
Channel Catfish	2												2	1	
Common Carp	9		1				1		1	1	2				
Common Shiner			1												
crappie sp.								5							
Emerald Shiner		1				1		1	3						1
Freshwater Drum	2			1		1						1			
Ghost Shiner	3	2			1			1							
Gizzard Shad		50	8		11	20		100	24			12			12
Golden Redhorse	1								1	1		1			1
Green Sunfish						1									
Largemouth Bass								1				1			
Log Perch		1						2							
Longnose Gar		1													
Mimic Shiner		2			2			1							
Northern Pike			1			1						1			
Pumpkinseed														1	
Quillback															
Rock Bass				1	3					1					
Shorthead Redhorse															1
Silver Redhorse	2								2			1			
Silver Shiner								1							
Spotfin Shiner		1						1	1						1
sucker sp.								1							
Walleye												2	6		
White Bass									1				8		
White Crappie		2			1										
White Perch							1							1	
White Sucker					1										
Yellow Perch								1				1			
Total Fish	**20**	**64**	**14**	**3**	**32**	**34**	**2**	**115**	**37**	**3**	**2**	**24**	**16**	**3**	**17**
Total Species	**7**	**10**	**5**	**3**	**8***	**7**	**2**	**11**	**8**	**3**	**1**	**10**	**3**	**3**	**6**
Common Species	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**3**	**4**	**2**	**1**	**1**	**1**	**1**	**0**

* *centrarchid* sp. was not considered a separate species as other centrarchids were caught at the site.